Data in the Optical Domain (DoD)

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Dr. Jag Shah
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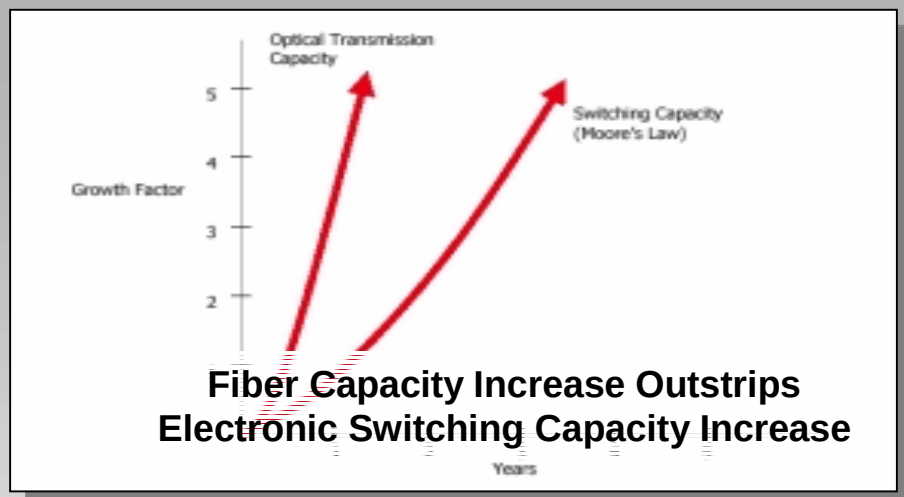
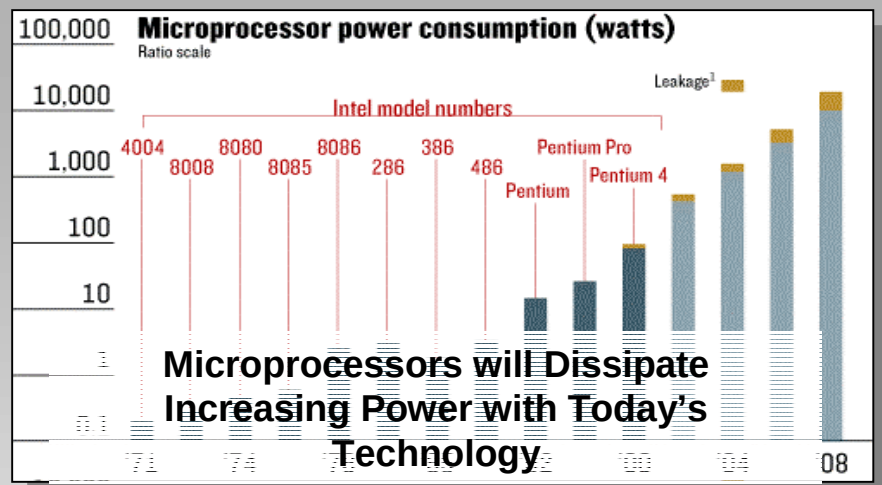
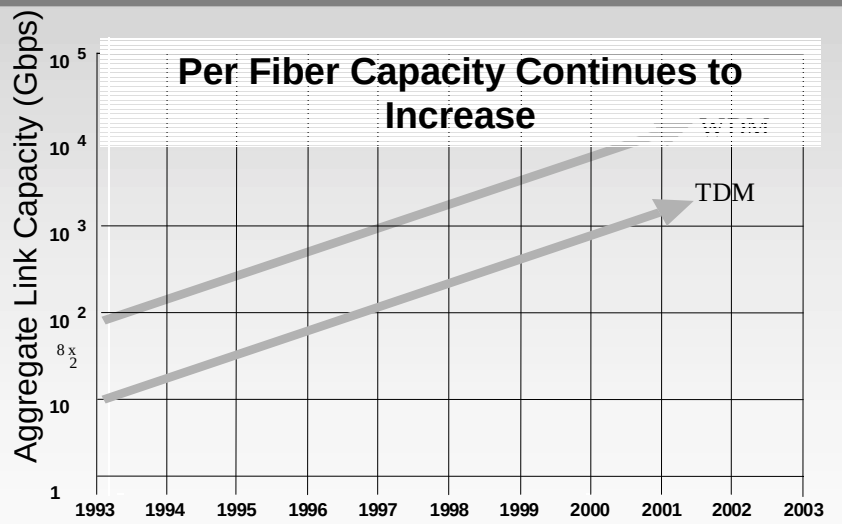
Optical Network Bandwidth Bottlenecks

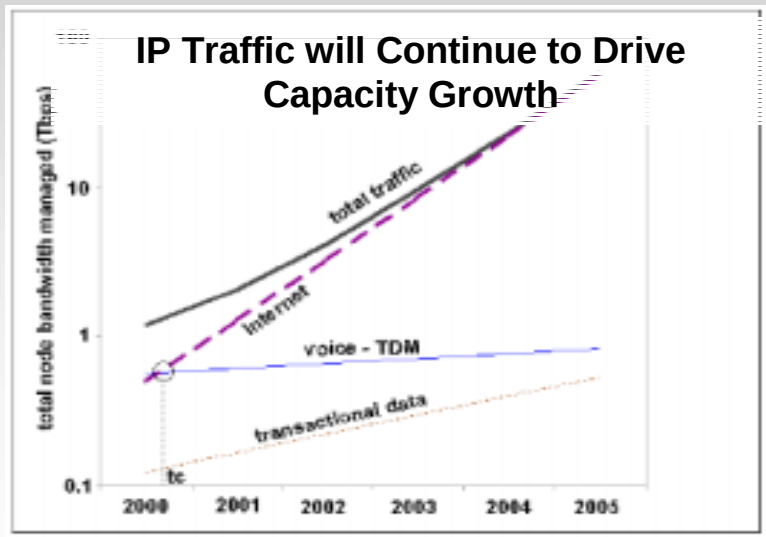


Fiber Capacity Increase Outstrips Electronic Switching Capacity Increase



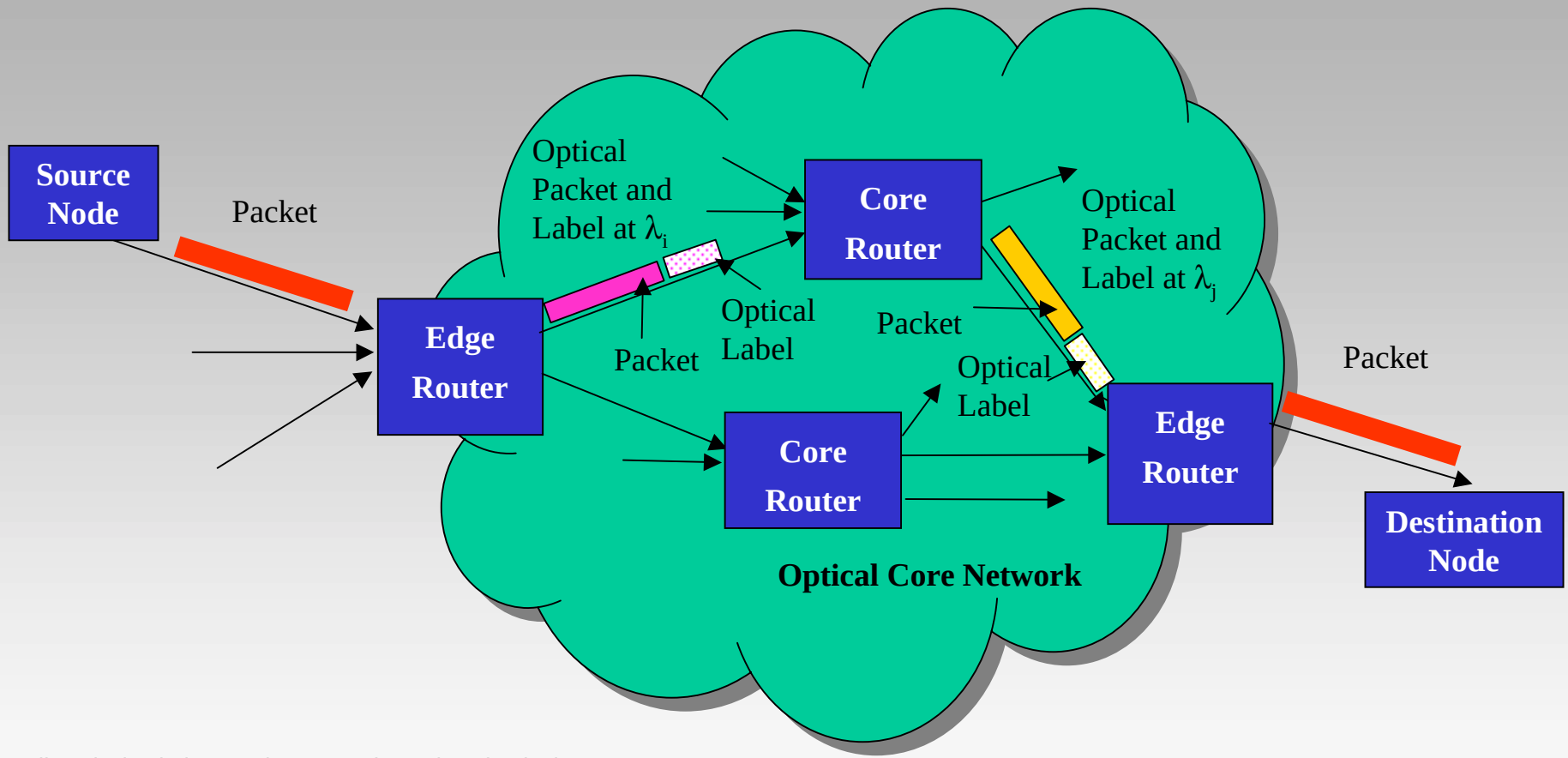
Microprocessors will Dissipate Increasing Power with Today's Technology





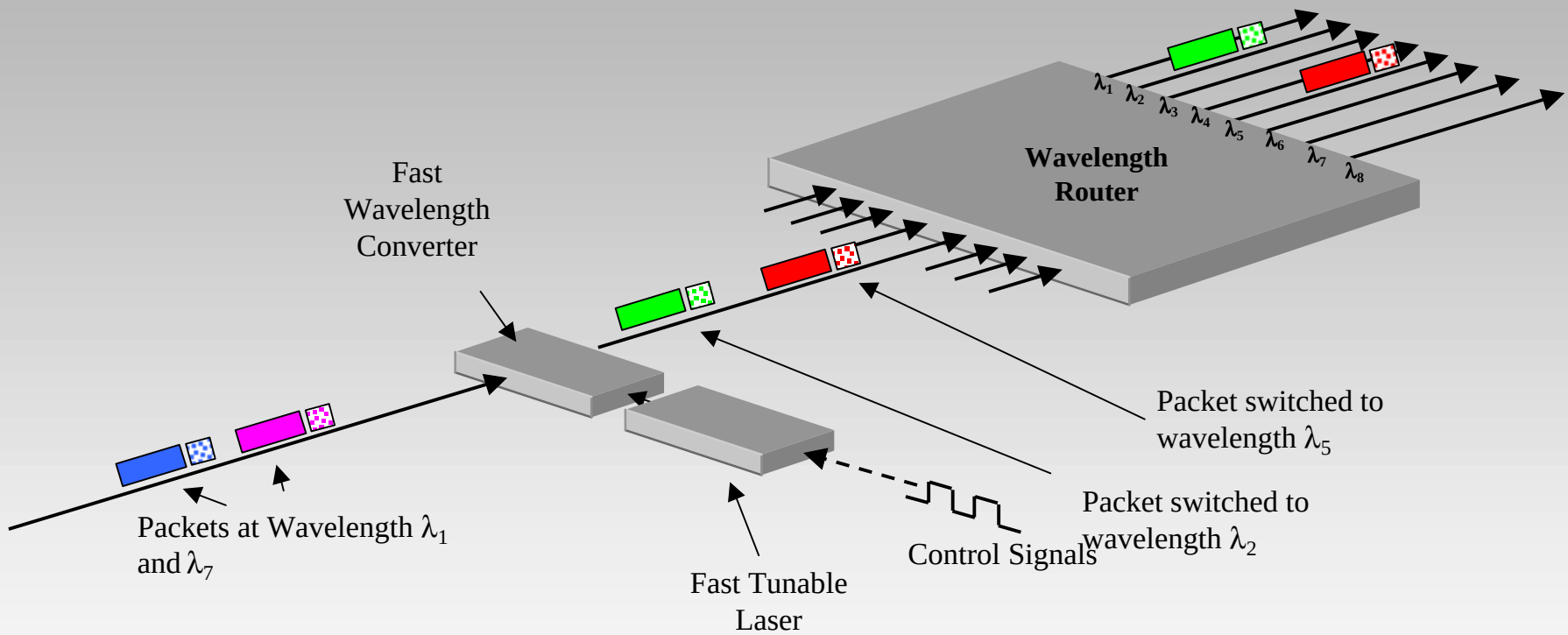
"Greenfield Optical Switched Transport Networks: A Cost Analysis," C.R. Lima, M.Allen and B.Faer, NFOEC, 2001.

All-Optical Label Swapping



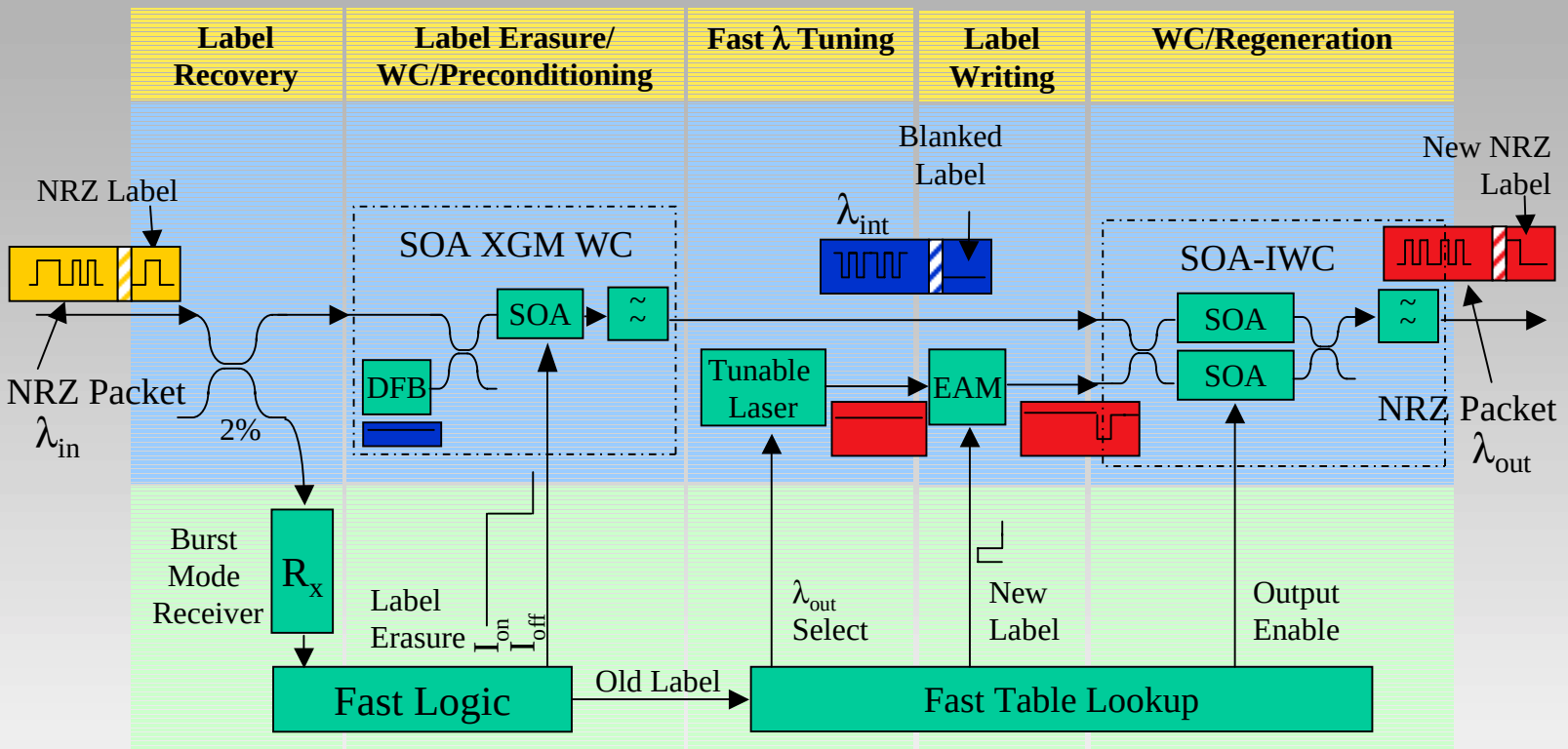
"All-Optical Label Swapping Networks and Technologies," D. J. Blumenthal, et. al., *IEEE Journal of Lightwave Technology,* Special Issue on Optical Networks, **18**(12), pp. 2058-2075, December 2000 (Invited Paper).

Optical Packet Routing using Wavelength Conversion



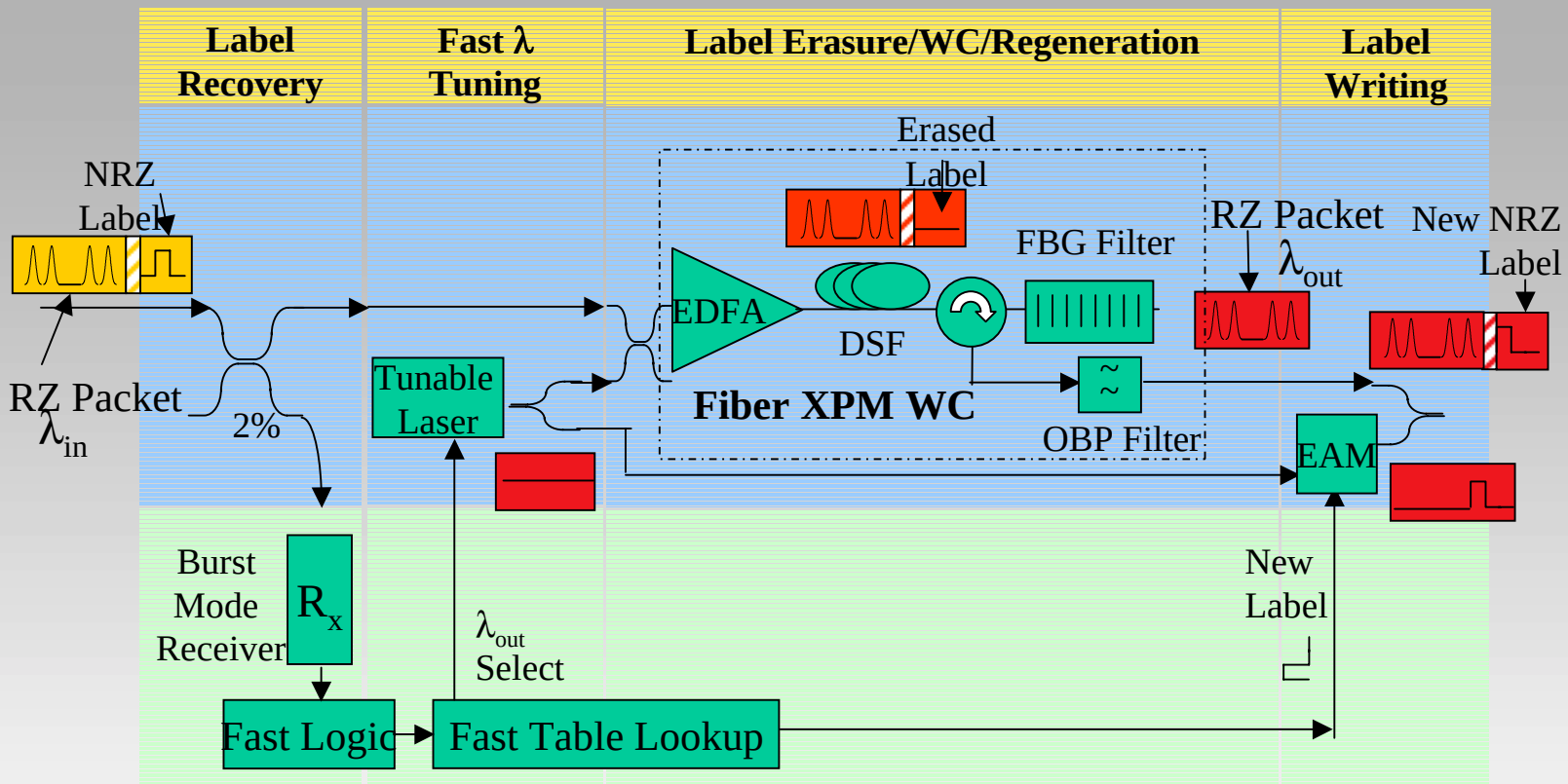
"All-Optical Label Swapping for the Future Internet," D. J. Blumenthal, *Optics and Photonics News*, 13(3), March 2002 (invited).

InP SOA AOLS with Fast WC



"Optical Signal Processing for Optical Packet Switching Networks," D. J .Blumenthal, J. E. Bowers, L. Rau, H.- F. Chou, S. Rangarajan, W. Wang and H. Poulsen, *IEEE Communications Magazine*, pp. 523-529, Feb. 2003 (Invited Paper)

Ultrafast AOLS using Nonlinear Fiber WC



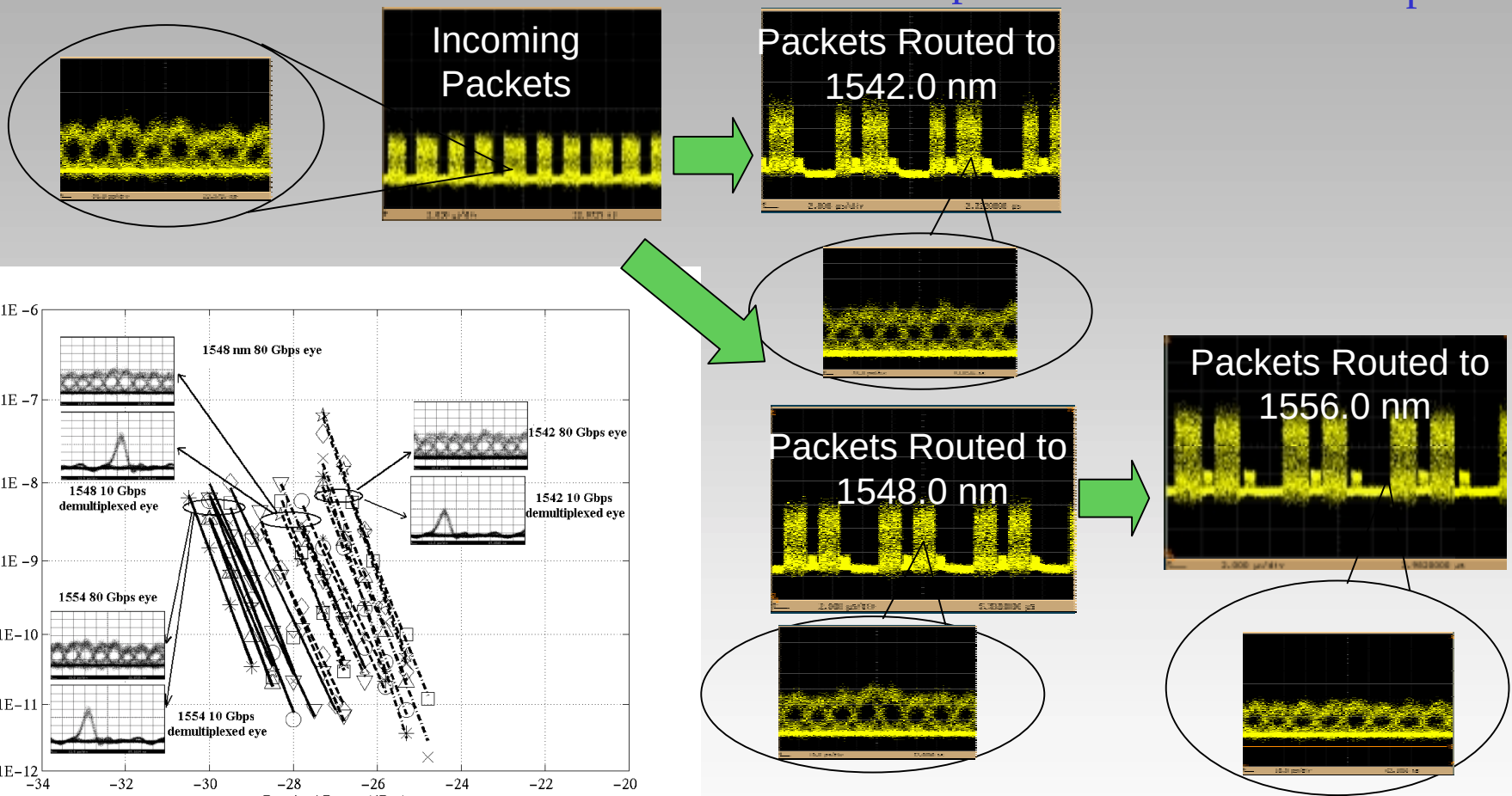
"Optical Signal Processing for Optical Packet Switching Networks," D. J .Blumenthal, J. E. Bowers, L. Rau, H.- F. Chou, S. Rangarajan, W. Wang and H. Poulsen, *IEEE Communications Magazine*, pp. 523-529, Feb. 2003 (Invited Paper)

80 Gbps Optical Packet Routing with Label Swapping

(L. Rau et. al. OFC Postdeadline Paper, 2002)

1st Hop

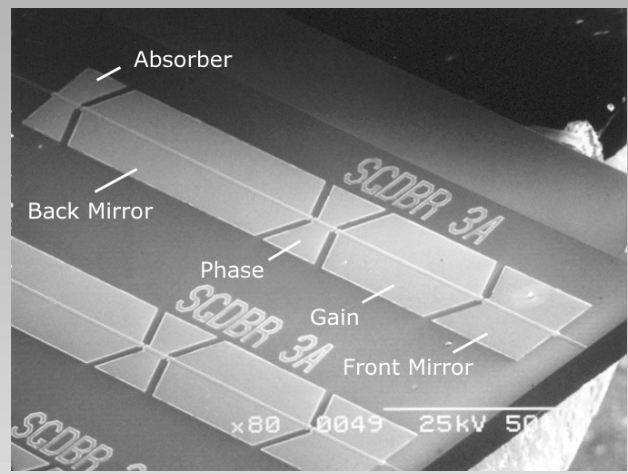
2nd Hop

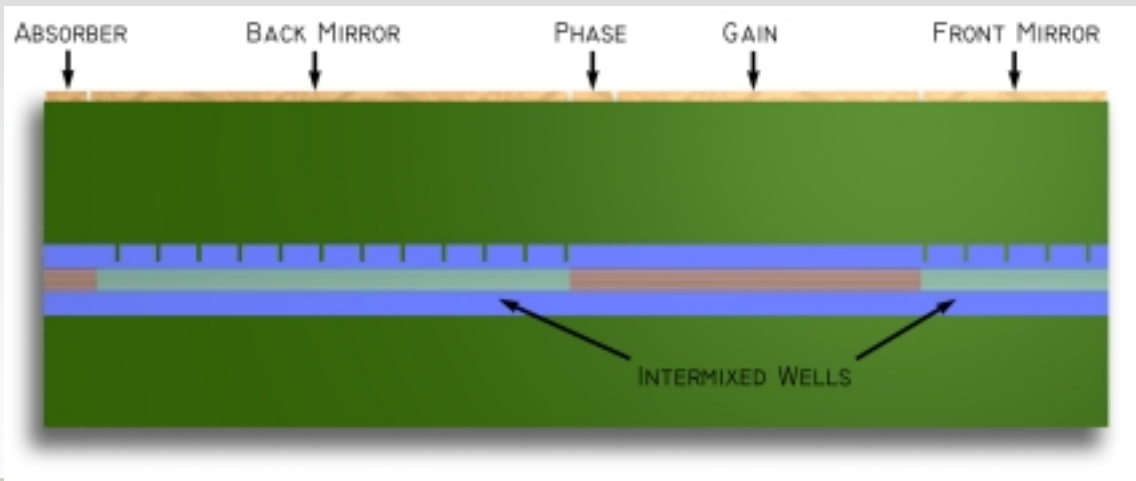


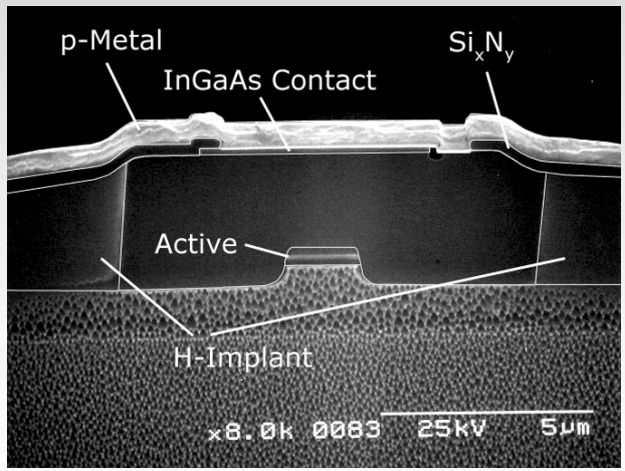
Multisection Lasers: SGDBR with Buried-Ridge

E. Skogan, L. A. Coldren, UCSB

- Widely-tunable SGDBR laser
  - Several active sections
    - Centered quantum well design
    - Provides 50% more modal gain than the offset quantum wells
  - Several tuning sections
    - Use the QWI process
    - provide the required tuning range







InP based 2D photonic crystal devices

Aimin Xing, Marcelo Darvanco, Daniel Blumenthal, Evelyn Hu

Objective

1. Fabrication of photonic crystal devices in InP material system
2. Investigate the transmission properties of the photonic crystal devices

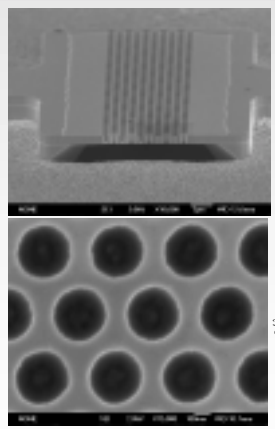
Approach

1. Fabrication of photonic crystals by e-beam lithography followed by MHA RIE
2. Transmission measurements of photonic crystal devices using tunable laser source
3. Correlate the measurement results to the calculated band structure

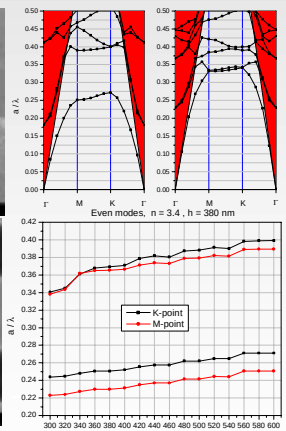
Accomplishments

1. Developed the fabrication process for InP based 2D photonic crystal membrane devices
2. Identified the band gap in the range between 1500nm to 1600nm by transmission measurements

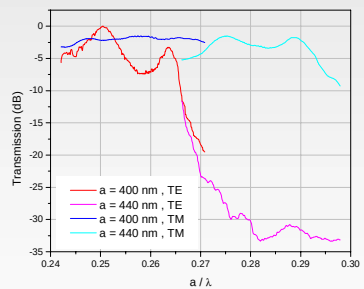
Fabricated Photonic Crystal membrane



Band gap diagram



Measured transmission spectrum



University of California
Santa Barbara

Status of Experimental Optical Packet Switching and Label Swapping Technology

- Where is it today
  - Basic functions of optical packet switching have been demonstrated: Optical header/label recovery, removal, processing, reinsertion, packet routing/forwarding, limited packet buffering
  - New techniques have been developed to make up for lack of optical random access and dynamic memory
  - Recent experimental work has started to address variable length packets
- What are potential technologies
  - Rapid waveguide switches, fast wavelength tuning, wavelength routers, fiber delay lines
- What are the most difficult issues
  - Optical random access buffering
  - Handling variable length packets
  - Network transmission engineering and interoperability
- Reduce cost of optics
- Move photonics from the 1950s of electronics into the VLSI era (photonic plumbing is expensive)
- Introduce regenerative functions into optical layer